

REMARKS

This application is believed to be in condition for allowance because the claims are non-obvious and patentable over the cited references. The following paragraphs provide the justification for this belief. In view of the following reasoning for allowance, the applicant hereby respectfully requests further examination and reconsideration of the subject patent application.

1.0 Election/Restrictions:

In accordance with the Examiner Interview conducted between Examiner Ryan J. Miller, and Attorney Mark A. Watson, Reg. No. 41,370, on June 3, 2003, and in accordance with the Interview Summary attached to the Office Action dated June 18, 2003, the applicant hereby elects the claims of Group 1 (claims 1-43) without traverse for purposes of examination.

2.0 Claim Objections under 37 CFR §1.75(a):

In the Office Action of June 18, 2003, claims 24 and 25 were objected to as failing to particularly point out and distinctly claim the subject matter which the applicant regards as his invention or discovery. In particular, the Examiner correctly identified an incorrect dependency in claim 24 which resulted in problems with the antecedent basis in claims 24 and 25. In response, the applicant has amended claim 24 to depend from claim 23 rather than from claim 21. Consequently, the applicant believes that the problem with antecedent basis in claims 24 and 25 is now corrected. Therefore, the applicant respectfully requests further consideration of claims 24 and 25 in view of the amendment to claim 24.

3.0 Rejections under 35 U.S.C. §102(b):

In the Office Action of June 18, 2003, claims 1-8, 10, 13-22, 28, 29, and 33-35 were rejected under 35 U.S.C. §102(b), as being anticipated by Birchfield (the article entitled "Elliptical Head Tracking Using Intensity Gradients and Color Histograms", hereinafter "**Birchfield**"). A rejection under 35 U.S.C. §102(b) requires that the applicant's invention was described in a printed publication more than one year prior to the date of application for patent in the United States. To establish that a patent describes the applicant's invention, all of the claimed elements of an applicant's invention must be considered, especially where they are missing from the prior art. If a claimed element is not taught in the cited reference, then a rejection under 35 U.S.C. §102(b) is not proper, as the applicant's invention can be shown to be patentably distinct from the cited reference.

3.1 Rejection of Claims 1 and 15 and 34:

The Office Action rejected independent claims 1, 15 and 34 under 35 U.S.C. §102(b), based on the rationale that the **Birchfield** reference discloses each of the elements of the applicant's claimed "...system for tracking at least one object in at least one sequential image...", "...process for generating a color-based object model...", and "...computer-readable memory for identifying the configuration of objects of interest in a scene..." However, in view of the following discussion, the applicant respectfully traverses the rejection of claims 1, 15, and 34, and rejection of the corresponding dependent claims. In general, the Office Action suggests that the **Birchfield** reference discloses "(c) automatically learn a color-based object model using the state estimate and the observations". In support of this argument, the Office Action offers Section 2 of the **Birchfield** reference.

In particular, the Office Action suggests that Section 2 of the **Birchfield** reference "describes the use of the combination of the intensity gradients around the

object's boundary (i.e. state estimate) and the color histogram of the object's interior (i.e. observations) to form a model for tracking the object."

However, the text of Section 2 of the **Birchfield** reference clearly states that it makes use of a **fixed** model. In particular, **Birchfield** states:

The head is modeled as a vertical ellipse with a fixed aspect ratio of 1:2, so that (x, y) is the center of the ellipse and σ is the length of the minor axis. We will use the notation $s = (x, y, \sigma)$ for the head's state or location. The tracking task is to update the state by finding the location whose image values best match the values in the model.

This is accomplished via a hypothesize-and-test procedure [4, 7] in which the goodness of the match is dependent upon the intensity gradients around the object's boundary and the color histogram of the object's interior" (emphasis added)

state estimate
(not color model)

Clearly, **Birchfield** is describing the use of a **fixed** object model for modeling the head "as a vertical ellipse with a fixed aspect ratio". Further, as noted above, the Office Action advances the suggestion that "the use of the combination of the intensity gradients around the object's boundary... and the color histogram of the object's interior... form a model..." However, in contrast to the position advanced by the Office Action, it appears that **Birchfield** discloses that the "intensity gradients around the object's boundary and the color histogram of the object's interior" are used to test the "goodness" of a match to the values in the existing **fixed** model. In fact, as noted above, Birchfield clearly states "The tracking task is to update the state by finding the location whose image values best match the values in the model. This is accomplished via a hypothesize-and-test procedure [4, 7] in which the goodness of the match is dependent upon the intensity gradients around the object's boundary and the color histogram of the object's interior."

Birchfield is apparently using the intensity gradients and color histograms to make **comparisons** to the fixed model rather than **learning** a model. Therefore, **Birchfield** does **not** automatically learn the object model, said model being “**a vertical ellipse with a fixed aspect ratio**” (emphasis added). Clearly, a model represented as a vertical ellipse with a **fixed**, predefined aspect ratio, is **not** automatically learned.

In stark contrast, the applicant clearly describes and claims **automatically learning** a color-based object model using the state estimate and the observations. Automatic learning of the object model is an important part of the applicant’s claimed invention.

Consequently, with respect to independent claim 1, the applicant respectfully suggests that the **Birchfield** reference clearly fails to teach the applicant’s claimed element of “**automatically learn a color-based object model** using the state estimate and the observations” (emphasis added). Similarly, with respect to independent claim 15, the applicant respectfully suggests that the **Birchfield** reference again clearly fails to teach the applicant’s claimed element of “**automatically learning the color-based object model** using the state estimates and the observations” (emphasis added). Finally, with respect to claim 34, the applicant respectfully suggests that the **Birchfield** reference again clearly fails to teach the applicant’s claimed element of “**automatically learn the color-based object model** by determining probabilistic relationships between the initial configuration estimates and the pixel color information” (emphasis added). Therefore, in view of the preceding discussion, it is clear that **Birchfield** fails to teach the **automatic learning** of object models.

Thus, the present invention, as claimed by independent claim 1, has elements not taught in the **Birchfield** reference. Consequently, the rejection of claim 1 under 35 U.S.C. §102(b) is not proper. Therefore, the applicant respectfully traverses the rejection of claim 1, and of dependent claims 2-8, 10, and 13-14, and objection to claims 11 and 12 under 35 U.S.C. §102(b). Thus, the applicant respectfully requests reconsideration of the rejection of claims 1-8, 10, and 13-14, and of the objection to

claims 11 and 12 in view of the language of claim 1 which recites the following novel language:

“A system for tracking at least one object in at least one sequential image, comprising:

a general purpose computing device; and

a computer program comprising program modules executable by the computing device, wherein the computing device is directed by the program modules of the computer program to:

(a) generate a state estimate defining probabilistic configurations of each object for each sequential image;

(b) generate observations of pixel color for each sequential image;

(c) ***automatically learn a color-based object*** model using the state estimate and the observations; and

(d) automatically track each object using the learned color-based model with a color-based tracking function.” (emphasis added)

Similarly, in view of the preceding discussion, it is clear that the present invention, as claimed by independent claim 15, also has elements not taught in the ***Birchfield*** reference. Consequently, the rejection of claim 15 under 35 U.S.C. §102(b) is not proper. Therefore, the applicant respectfully traverses the rejection of claim 15, and thus of dependent claims 16-22, 28, 29, and 33, and objection to claims 23 and 30-32 under 35 U.S.C. §102(b). Thus, the applicant respectfully requests reconsideration of the rejection of claims 15-22, 28, 29, and 33, and objection to claims 23 and 30-32 under 35 U.S.C. §102(b) in view of the language of claim 15 which recites the following novel language:

“A computer-implemented process for generating a color-based object model, comprising:

generating a state estimate defining probabilistic states of an object for each of at least one sequential images;
generating observations of pixel color for each sequential image;
and
automatically learning the color-based object model using the state estimates and the observations” (emphasis added)

Finally, in view of the preceding discussion, it is clear that the present invention, as claimed by independent claim 34, also has elements not taught in the ***Birchfield*** reference. Consequently, the rejection of claim 15 under 35 U.S.C. §102(b) is not proper. Therefore, the applicant respectfully traverses the rejection of claim 34, and thus of dependent claim 35, and objection to claims 38-43 under 35 U.S.C. §102(b). Thus, the applicant respectfully requests reconsideration of the rejection of claims 34-35 and objection to claims 38-43 under 35 U.S.C. §102(b) in view of the language of claim 34 which recites the following novel language:

“A computer-readable memory for identifying the configuration of objects of interest in a scene, comprising:

a computer-readable storage medium; and

a computer program comprising program modules stored in the storage medium, wherein the storage medium is so configured by the computer program that it causes the computer to,

generate an initial configuration estimate for objects of interest within the scene,

identify pixel color information within the scene that is relevant to a learned color-based object model,

automatically learn the color-based object model by determining probabilistic relationships between the initial configuration estimates and the pixel color information, and,

generate a final configuration estimate for objects of interest in the scene by using the color-based object model in combination with a color-based tracking function.” (emphasis added)

4.0 Rejections Under 35 U.S.C. §103(a):

In the Office Action of June 18, 2003, claims 9, 36 and 37 were rejected under 35 U.S.C. §103(a) as being unpatentable over **Birchfield** in view of Koller, et al, (the article entitled “Using Learning for Approximation in Stochastic Processes”, hereinafter “**Koller**”).

In order to deem the applicant’s claimed invention unpatentable under 35 U.S.C. §103(a), a prima facie showing of obviousness must be made. However, as fully explained by the M.P.E.P. Section 706.02(j), to establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.**

Further, in order to make a prima facie showing of obviousness under 35 U.S.C. 103(a), **all of the claimed elements of an applicant’s invention must be considered, especially when they are missing from the prior art.** If a claimed element is not taught in the prior art and has advantages not appreciated by the prior art, then no prima facie case of obviousness exists. The Federal Circuit court has stated that it was error not to distinguish claims over a combination of prior art references where a material limitation in the claimed system and its purpose was not taught therein (*In Re Fine*, 837 F.2d 107, 5 USPQ2d 1596 (Fed. Cir. 1988)).

4.1 Rejection of Claims 9, 36 and 37:

The Office Action rejected dependent claims 9, 36 and 37 under 35 U.S.C. 103(a) based, in part, on the rationale that while **Birchfield** failed to disclose the use of Dirichlet functions, this element was disclosed by **Koller**, and that it would therefore be obvious to modify **Birchfield** by adding the use of a Dirichlet function as taught by **Koller**.

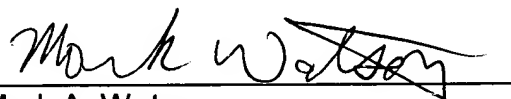
However, in accordance with the preceding discussion regarding independent claims 1, 15 and 34, it is clear that **Birchfield** fails to disclose the automatic learning of color-based object models as described and claimed by the applicant, and that in fact, claims 1, 15 and 34 of the applicant's invention have been shown to be allowable under 35 U.S.C. §102(b). Consequently, the addition of **Koller** Dirichlet function to the **Birchfield** reference still fails completely to disclose the applicant's claimed element of automatically learning color-based object models. In fact, where the parent claim has been shown to be patentable, the use of a secondary reference to address a particular element of a dependent claim does not satisfy the requirements of either M.P.E.P. Section 706.02(j), or 35 U.S.C. §103(a).

Therefore, the rejection of claims 9, 36 and 37 under 35 U.S.C. §103(a) fails to meet the requirements of M.P.E.P. Section 706.02(j). In particular, the **Birchfield-Koller** combination fails to teach all of the elements of the claimed invention. This lack of a prima facie showing of obviousness means that rejected claims 9, 36 and 37 are patentable under 35 U.S.C. §103(a). Thus, the applicant respectfully traverses the rejection of claims 9, 36 and 37, and requests reconsideration of the rejection of those claims under 35 U.S.C. §103(a). The basis for this patentability is the nonobvious language of independent claims 1 and 34, as cited above.

CONCLUSION

In view of the above, it is respectfully submitted that claims 1-43 are in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of claims 1-10, 13-22, 28, 29, and 33-37, and objection to claims 11-12, 23-27, 30-32, and 38-43, and to pass this application to issue. Additionally, in an effort to further the prosecution of the subject application, the applicant kindly invites the Examiner to telephone the applicant's attorney at (805) 278-8855 if the Examiner has any questions or concerns.

Respectfully submitted,

A handwritten signature in cursive script, reading "Mark A. Watson", written over a horizontal line.

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